

WHAT IS CLAIMED IS:

1. A scanning exposure apparatus for exposing a substrate to a pattern of an original through a projection optical system, while scanning the original and the substrate, comprising:

a first detection system which detects a first substrate reference mark corresponding to the substrate through said projection optical system from at least one of an on-axis position on an optical axis of said projection optical and an off-axis position apart from the optical axis in a scanning direction; and

an alignment system which aligns the original and the substrate based on a detection result of said first detection system.

2. An apparatus according to claim 1, wherein the first substrate reference mark is formed on a stage which moves the substrate.

3. An apparatus according to claim 1, wherein said first detection system detects a positional error between an original reference mark corresponding to the original and the first substrate reference mark.

4. An apparatus according to claim 1, further comprising a second detection system which detects a second substrate reference mark corresponding to the substrate through said projection optical system from an off-axis position apart from the optical axis in a direction perpendicular to the scanning direction.

5. An apparatus according to claim 4, wherein said alignment system aligns the original and the substrate based on detection results of said first and second detection systems.

5 6. An apparatus according to claim 1, further comprising a third detection system which detects a third substrate reference mark corresponding to the substrate not through said projection optical system.

7. An apparatus according to claim 6, wherein said
10 alignment system calculates a correction value with respect to said third detection system based on detection results of said first and third detection systems.

8. An apparatus according to claim 1, further
15 comprising a fourth detection system which detects a fourth substrate reference mark corresponding to the substrate through said projection optical system.

9. An apparatus according to claim 8, wherein said alignment system calculates a correction value with
20 respect to said fourth detection system based on detection results of said first and fourth detection systems.

10. An apparatus according to claim 1, wherein said alignment system calculates an origin offset of a stage
25 which moves the original, based on the detection result of said first detection system.

11. An apparatus according to claim 3, wherein said

alignment system corrects a difference in travel between the original and the substrate based on the detection result of said first detection system.

12. An apparatus according to claim 1, wherein said
5 first detection system detects a positional error between a measurement mark which is formed on the original, and the first substrate reference mark.

13. An apparatus according to claim 12, wherein said
10 alignment system calculates a rotational position of the original with respect to the optical axis of said projection optical system based on the detection result of said first detection system.

14. An apparatus according to claim 12, wherein said
15 alignment system calculates a deformation amount of the original based on the detection result of said first detection system.

15. An apparatus according to claim 1, wherein said
20 first detection system detects the first substrate reference mark during the exposure from the off-axis position.

16. An apparatus according to claim 1, wherein said
first detection system is movable in the scanning direction.

17. An apparatus according to claim 16, wherein said
25 first detection system detects the first substrate reference mark from the on-axis position and the off-axis position.

18. An apparatus according to claim 16, wherein said first detection system detects the first substrate reference mark from a wait position during the exposure.

5 19. An apparatus according to claim 18, wherein said first detection system detects the first substrate reference mark during the exposure.

20. An apparatus according to claim 18, further comprising a third detection system which detects a
10 third substrate reference mark corresponding to the substrate not through said projection optical system, wherein said third detection system detects the third substrate reference mark with respect to the same position of the substrate as the position with respect
15 to which said first detection system detects the first substrate reference mark.

21. An apparatus according to claim 20, wherein said alignment system calculates a correction value with respect to said third detection system based on
20 detection results of said first and third detection systems.

22. An apparatus according to claim 1, wherein said first detection system detects the first substrate reference mark using light of which wavelength is
25 substantially the same as wavelength of light used for the exposure.

23. An apparatus according to claim 4, further

comprising a fourth detection system which detects a fourth substrate reference mark corresponding to the substrate through said projection optical system from an off-axis position apart from the optical axis in a direction perpendicular to the scanning direction, wherein said first, second and fourth detection systems detect the first, second and fourth substrate reference marks using light of which wavelength is substantially the same as wavelength of light used for the exposure, respectively.

24. A device manufacturing method, comprising a step of exposing a substrate to a pattern using a scanning exposure apparatus defined in claim 1.